



Living in the Water

All aquatic species, including fish and other aquatic animals, are uniquely adapted to life in or around water.

Estimated Time

Three 50-minute
class sessions

Technology Tools/Skills Used in Chapter

Retrieving reliable
information from the
Internet and other media.

Safety Precautions/Concerns

None

Vocabulary

Adaptation
Fin
Gill
Lateral line
Predator
Prey
Scale
Streambed
Swim bladder

Chapter Objectives

Students will be able to:

1. Define species and give a Missouri-specific example of an aquatic species.
2. Define adaptation and identify specific adaptations of aquatic species native to Missouri.
3. Predict how certain adaptations may offer a survival advantage to a species in an aquatic environment.
4. Explain how fish swim.
5. Explain how fish see, smell, hear, taste and feel.
6. Compare and contrast fish species and other aquatic animal species native to Missouri.

Targeted Grade-Level Expectations

EC.3.C.6.a. Relate examples of adaptations (specialized structures or behaviors) within a species to its ability to survive in a specific environment (e.g., hollow bones/flight, hollow hair/insulation, dense root structure/compact soil, seeds/food, protection for plant embryo vs. spores, fins/movement in water)

EC.3.C.6.b. Predict how certain adaptations, such as behavior, body structure, or coloration, may offer a survival advantage to an organism in a particular environment

IN.1.A.6.a.

IN.1.A.6.b.

IN.1.A.6.c.

IN.1.B.6.a.

IN.1.B.6.b.

IN.1.B.6.c.

IN.1.B.6.d. Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, temperature to the nearest degree Celsius, force (weight) to the nearest Newton, time to the nearest second

IN.1.B.6.e.

IN.1.C.6.a.

IN.1.C.6.b.

IN.1.E.6.a. Communicate the procedures and results of investigations and explanations through:

- oral presentations
- drawings and maps
- **data tables (allowing for the recording and analysis of data relevant to the experiment, such as independent and dependent variables, multiple trials, beginning and ending times or temperatures, derived quantities)**
- graphs (bar, single line, pictograph)
- writings

Reference Material for Teacher Background

- Critter Cards: Benthic Macroinvertebrates (STR295)
- DVD Compilation for *Conserving Missouri's Aquatic Ecosystems*
- Introduction to Crayfish (FIS011)
- Introduction to Missouri Fishes (FIS020)
- Know Missouri's Catfish (FIS003)
- Life Within the Water (FIS034)
- Map: Smallmouth Bass (FIS019)
- Map: Trout Fishing In Missouri (FIS210)
- Missouri Aquatic Snails (SCI017)
- Missouri Fresh Water Mussels (E00019)
- Missouri Marsh Birds (E00042)
- Missouri Toads and Frogs (E00430)
- Missouri Turtles (E00468)
- Poster: Aquatic Invasive Species (FIS029)
- Poster: Missouri Fishes (E00013)
- Poster: Salamander (E00089)
- Poster: Toads & Frogs (E00012)
- Poster: Wetlands & Waterfowl (E00115)
- *Crayfishes of Missouri* (01-0250)
- *Fishes of Missouri* (01-0031)
- *Amphibians and Reptiles of Missouri* (01-0190)
- *Missouri Naiads* (01-0150)
- *Pond Life: Revised and Updated (A Golden Guide from St. Martin's Press)* by George K. Reid

Required Materials

- DVD Compilation for *Conserving Missouri's Aquatic Ecosystems*
- Poster: Toads & Frogs (E00012)
- Missouri Fishes poster (E00013)
- Missouri Fresh Water Mussels (E00019)
- Missouri Marsh Birds (E00042)
- Poster: Salamander (E00089)
- Missouri Toads and Frogs (E00430)
- Missouri Turtles (E00468)
- Know Missouri's Catfish (FIS003)
- Introduction to Crayfish (FIS011)
- Introduction to Missouri Fishes (FIS020)
- Life Within the Water (FIS034)
- Missouri Aquatic Snails (SCI017)
- *Missouri Naiads* (01-0150)
- *Crayfishes of Missouri* (01-0250)
- *Fishes of Missouri* (01-0031)
- TV/DVD player
- 1 blank Missouri Fish and Their Characteristics comparison matrix for each student
- 1 copy of the Writing Scoring Guide for each student
- Notebook paper
- Pens or pencils
- Computer with internet connectivity (optional)

Activity 4.1: Exploration of Students' Current Understanding of Species Adaptations

This activity explores students' current understanding of species adaptations, particularly those of fish and other aquatic animals.

Estimated Time

10 minutes

Required Materials

None

Procedure

1. Use a cooperative learning activity to explore the following questions:
 - Why don't fish walk on land?
 - Why can't people breathe under water?
 - If you go swimming a lot, will you start to grow gills and fins? Why or why not?
2. Explain to the class that this chapter will help them understand how fish and other aquatic animals are specially suited for the lives they lead.

Activity 4.2: Video Introduction of Missouri Fishes

This activity helps students understand the concept of species and provides Missouri-specific examples of aquatic species.

Estimated Time

20 minutes

Required Materials

- DVD Compilation for *Conserving Missouri's Aquatic Ecosystems*
- Missouri Fishes poster (E00013)
- TV/DVD player

Procedure

1. Display the Missouri Fishes poster in the classroom. Invite students to share their “fish stories” with the class, that is, to briefly relate an experience they’ve had with a fish. Ask students to name the fish species and identify them on the poster if they are pictured.
2. Show the video clip: “Missouri Hatcheries.”

Activity 4.3: Student Reading and Research

This activity provides students with definitions and explanations about adaptations of fish and other aquatic animals.

Estimated Time

Varies—class time may be provided or reading may be assigned as homework. Allow at least 20 minutes for in-class questions and discussion.

Required Materials

- Student Guide
- Notebook paper (optional)
- Pens or pencils (optional)

Procedure

1. Have students read Chapter 4: Living in the Water. Introduce vocabulary terms as needed.
2. Assign the **Questions to Consider** as homework or use them in a cooperative learning activity.
 1. What is a species?
A species is a group of individuals sharing some common characteristics or qualities and whose offspring also share those characteristics or qualities. In other words, a species is a particular kind of creature.
 2. What is an adaptation?
An adaptation is a behavior or trait that increases a species' chance of survival in a specific environment.
 3. How are fish adapted to aquatic environments?
Answers may include:
 - All fish are cold blooded. Their body temperature depends on the surrounding water temperature. This means they need less oxygen and energy to live than warm-blooded animals do.
 - All fish have gills to get oxygen from the water.
 - Fish move about with the help of fins.
 - Swim bladders keep fish from sinking.
 - Most fish are covered with protective scales.
 - Fish are coated with slime, which helps reduce friction as they swim through the water.
 - Almost every fish species is dark-colored across the back and light on the belly. This helps them blend in to the dark bottom when seen from above, and with the bright surface when seen from below.
 - Fish have a sensitive line along their sides, called a lateral line, which lets them sense water vibrations coming from each direction.
 4. How do fish swim? Why don't fish sink to the bottom or float on top of the water?
When a fish wants to move forward, it begins a side-to-side wiggle that starts at its front and moves to its back. As this wiggle goes backward, the fish goes forward. Swim bladders keep fish from sinking. The swim bladder works a little like a hot air balloon. The more air it contains, the higher a fish will suspend or float in the water.

5. How do fish see, smell, hear, taste and feel?

All fish are nearsighted, but the placement and shape of their eyes allows them to see almost all the way around their bodies. Fish can see colors, but those that feed at night or live on the bottom rely heavily on their excellent sense of smell. Some fish, like catfish, have taste buds all over their bodies, including the tail. They can taste food even before taking it into their mouths. Fish have super hearing, especially for low-frequency sounds. A fish's ears are located beneath the skin on either side of the head. Fish also have a sensitive line along their sides, called a lateral line, which lets them sense water vibrations coming from each direction. Lateral lines are usually visible as faint lines like racing stripes. These run lengthwise along each side from the gill covers to the base of the tail.

6. What are some adaptations of different species of fish native to Missouri?

Answers may include:

- **Bluegill have thin bodies, short heads, small mouths and protective coloring.**
- **Channel catfish have long, round bodies that are flattened on the bottom, skin without scales, barbels or "whiskers" with many taste buds and a good sense of smell, taste buds all over their bodies and dark-colored skin across the back and light on the belly.**
- **Largemouth bass have large mouths, broad fins and strong, heavy bodies with wide, sweeping tails. They have colored blotches on their sides.**

7. How do specific adaptations provide survival advantages to particular species?

Answers may include:

- **Bluegill's thin, disk-shaped body is ideal for short, quick turns. They need to be fast to catch food among plant stems. Their small mouths are suited for eating small insects. Their protective coloring helps them hide from their enemies.**
- **Channel catfish have barbels or "whiskers" with many taste buds and a good sense of smell to guide them to food even in dark, muddy waters. They have taste buds all over their bodies, including their tails, so they can taste food even before taking it into their mouths. Their skin color camouflages them against pond and river bottoms.**
- **Largemouth bass have large mouths that enable them easily to catch frogs, fish, crayfish and other animals. Their broad fins and strong, heavy bodies allow them to go in any direction (even backwards) as they seek food. Wide, sweeping tails give these predators quick powerful starts, enabling them to ambush their food. The colored blotches on their sides hide them well in weeds.**

Activity 4.4: Student Investigation of Missouri Fishes

This activity helps students understand the concept of species and provides Missouri-specific examples of fish species. It helps students understand the concept of adaptation and identifies specific adaptations of fish species native to Missouri.

Estimated Time

Varies—class time may be provided or research may be assigned as homework. Allow at least 20 minutes for in-class questions and discussion.

Required Materials

- DVD Compilation for *Conserving Missouri's Aquatic Ecosystems*
- Missouri Fishes poster (E00013)
- Know Missouri's Catfish (FIS003)
- Introduction to Missouri Fishes (FIS020)
- *Fishes of Missouri* (01-0031)
- TV/DVD player
- One blank Missouri Fish and Their Characteristics comparison matrix for each student
- Pens or pencils
- Computer with internet connectivity (optional)

Procedure

1. Distribute a blank Missouri Fish and Their Characteristics comparison matrix to each student.
2. Instruct students to choose three (or more) Missouri fish to investigate using video clip, online, in-class or library resources. Class time may be provided or research may be assigned as homework. Fish video clips include "Paddlefish," "Just Below The Surface (Grotto Sculpin)," "Lake Sturgeon" or "Big Bluegill."
3. Have students record their findings by completing rows of the comparison matrix. Have students add the matrix to their notebooks. This matrix will be used (added to) in later activities.

Missouri Fish and Their Characteristics

Species	Average adult		Body shape		Coloration	
	Weight in (units)	Length in (units)	Adaptation	Advantage	Adaptation	Advantage

Activity 4.5: Student Investigation of Missouri Aquatic Animals

This activity helps students understand the concept of species and provides Missouri-specific examples of non-fish aquatic animal species. It helps students understand the concept of adaptation and identifies specific adaptations of non-fish aquatic animal species native to Missouri.

Estimated Time

Varies—class time may be provided or reading may be assigned as homework. Allow at least 20 minutes for in-class questions and discussion.

Required Materials

- DVD Compilation for *Conserving Missouri's Aquatic Ecosystems*
- Poster: Toads & Frogs (E00012)
- Missouri Fresh Water Mussels (E00019)
- Missouri Marsh Birds (E00042)
- Poster: Salamander (E00089)
- Missouri Toads and Frogs (E00430)
- Missouri Turtles (E00468)
- Introduction to Crayfish (FIS011)
- Life Within the Water (FIS034)
- Missouri Aquatic Snails (SCI017)
- *Missouri Naiads* (01-0150)
- *Crayfishes of Missouri* (01-0250)
- TV/DVD player
- Notebook paper
- Pens or pencils
- One copy of the Writing Scoring Guide for each student
- Computer with internet connectivity (optional)

Procedure

1. Show the video clip: "Mussels." Lead class discussion of mussel adaptations.
2. Instruct students to choose at least two more non-fish aquatic animal species native to Missouri to investigate using video clip, online, in-class or library resources. Video clips include "Alligator Snapper Trapper," "Hellbender Mystery," "Taneycomo Turtles," "Cottonmouth!," "Canada Geese," "Eagle Days," "Otter Management" or "Salamanders." Class time may be provided or research may be assigned as homework.
3. Have students choose one of the animals they studied and report their findings in the form of an interview, biography or first-person narrative from the point of view of the animal. Provide a copy of the Writing Scoring Guide for each student.

Writing Scoring Guide

Be sure each paragraph:

- Contains an introductory sentence that clearly states your purpose
- Contains at least two supporting sentences that use relevant details
- Contains a concluding sentence
- Contains a controlling idea
- Progresses in a logical order
- Stays on topic
- Contains few errors in writing mechanics

Your score on this assignment will be based upon the following scoring guide:

4 Points

The paper:

- Has an effective beginning, middle and end.
- Uses paragraphing appropriately.
- Contains a strong controlling idea.
- Progresses in a logical order.
- Uses effective cohesive devices (such as transitions, repetition, pronouns, parallel structure) between and/or within paragraphs.
- Clearly addresses the topic and provides specific and relevant details/examples.
- Uses precise and vivid language.
- Contains sentences that are clear and varied in structure.
- Effectively uses writing techniques (such as imagery, humor, point of view, voice).
- Clearly shows an awareness of audience and purpose.
- Contains few errors in grammar/usage, punctuation, capitalization and/or spelling.

3 Points

The paper:

- Has a beginning, middle and end.
- Uses paragraphing.
- Contains a controlling idea.
- Generally progresses in a logical order.
- May use cohesive devices.
- Addresses the topic and uses relevant details/examples.
- Uses language that is usually precise.
- Contains sentences that are clear and show some variety in structure.
- Uses writing techniques.
- Shows an awareness of audience and purpose.
- May contain errors in grammar/usage, punctuation, capitalization and/or spelling that are not distracting to the reader.

2 Points

The paper:

- Has evidence of a beginning, middle and end.
- Shows evidence of paragraphing.
- Contains some sense of direction, but may lack focus.
- May not progress in a logical order.
- At times seems awkward and lacks cohesion.
- Addresses the topic, but may contain some details that are not relevant.
- May use imprecise language.
- Contains sentences that are generally clear, but lack variety in structure.
- May use writing techniques.
- Shows some awareness of audience and purpose.
- Contains errors in grammar/usage, punctuation, capitalization and/or spelling that may be distracting to the reader.

1 Point

The paper:

- May lack evidence of a beginning, middle and/or end.
- May lack evidence of paragraphing.
- Is difficult to follow and lacks focus.
- Does not progress in a logical order, and may digress to unrelated topics.
- Is awkward and lacks cohesion.
- May address the topic, but lacks details.
- Uses imprecise language.
- Contains sentences that are unclear and lack variety in structure.
- Does not use writing techniques.
- Shows little or no awareness of audience or purpose.
- Contains repeated errors in grammar/usage, punctuation, capitalization and/or spelling that are distracting to the reader.

Activity 4.6: Student Investigation of Fish Sampling

Students apply what they have learned in the preceding activities to create a data table to record fish sampling data and observations in preparation for their field study day.

Estimated Time

25 minutes

Required Materials

- Notebook paper
- Pens or pencils

Procedure

1. Instruct students to work in teams to decide the best way to record fish identification, sampling data and observations as part of their field study day.
2. Have each team create a data table and have each student make a copy for his/her notebook.

Chapter 4 Assessment

Directions

Select the best answer for each of the following multiple-choice questions.

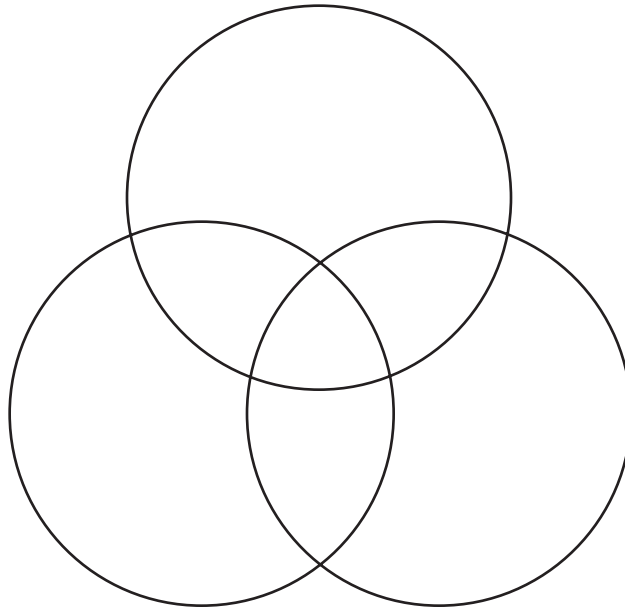
1. Why don't fish sink to the bottom or float on top of the water?
 - a. Water's surface tension
 - b. Fish absorb dissolved oxygen from water passing over their gills.
 - c. The more air a fish's swim bladder contains, the higher the fish will suspend or float in the water.
 - d. All of the above
2. Which of the following statements about adaptations is true?
 - a. Creatures can choose adaptations that will provide them with survival advantages.
 - b. Species adaptations provide them with survival advantages in a particular environment.
 - c. All aquatic species have the same adaptations.
 - d. Both b and c
3. What is a species?
 - a. A group of individuals sharing some common characteristics or qualities
 - b. Animals with a backbone
 - c. A particular kind of creature
 - d. Both a and c
4. What is the function of a fish's lateral line organ?
 - a. To taste food even before taking it into their mouths
 - b. To help them hide from their enemies
 - c. To reduce friction as fish swim through the water
 - d. To sense water vibrations coming from each direction
5. Why are fish coated with slime?
 - a. To absorb up to 85 percent of the oxygen available in the water
 - b. To help them blend in to the dark bottom when seen from above, and with the bright surface when seen from below
 - c. To reduce friction as fish swim through the water and to protect them from disease
 - d. None of the above

Chapter 4 Assessment

Directions

Write your own answer for each of the following questions.

1. Using the Venn Diagram below, sort some adaptations of the three species of fish you studied. Be sure to label each part of the diagram with the name of the fish species it represents. Assess the survival advantage of three of the adaptations in your diagram:
 - One which is shared by all three fish
 - One which is shared by two fish but not by the third fish
 - One which is displayed by only one of the three fish



2. Design a non-fish aquatic animal with adaptations that provide it with the following advantages:
 - It can avoid predators because it can see nearly all the way around itself.
 - It can walk on mud easily and is a powerful swimmer.
 - It can stay warm even in cold water.

You may use a drawing to depict your imaginary animal, but you should also use words to describe each adaptation. Use the back of this page.

Chapter 4 Assessment Answer Key

Multiple-choice questions

1. Why don't fish sink to the bottom or float on top of the water?
c. The more air a fish's swim bladder contains, the higher the fish will suspend or float in the water.
2. Which of the following statements about adaptations is true?
b. Species adaptations provide them with survival advantages in a particular environment.
3. What is a species?
d. Both a and c
4. What is the function of a fish's lateral line organ?
d. To sense water vibrations coming from each direction
5. Why are fish coated with slime?
c. To reduce friction as fish swim through the water and to protect them from disease

Write-in questions

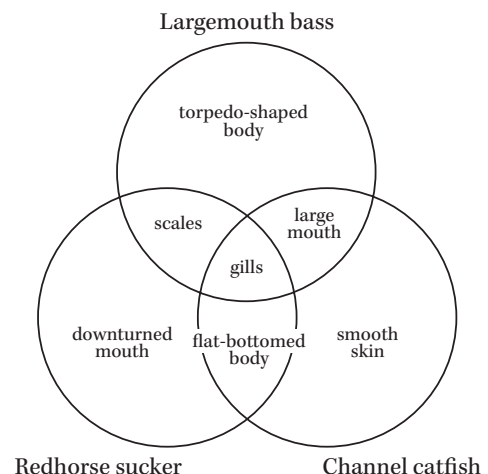
1. Using the Venn Diagram below, sort some adaptations of the three species of fish you studied. Be sure to label each part of the diagram with the name of the fish species it represents. Assess the survival advantage of three of the adaptations in your diagram:

- One that is shared by all three fish
- One that is shared by two fish but not by the third fish
- One that is displayed by only one of the three fish

Many answers are possible, but all should resemble the following example:

- **Shared by all three fish: Gills allow fish to extract oxygen from the water.**
- **Shared by two fish but not by the third fish: Scales protect the fish from enemies.**
- **Displayed by only one of the three fish: Downturned mouth allows fish to suck food up from the bottom.**

Instructors may wish to refer to Introduction to Missouri Fishes (FIS020) and Fishes of Missouri (01-0031) for guidance in scoring.



2. Design a non-fish aquatic animal with adaptations that provide it with the following advantages:
 - It can avoid predators because it can see nearly all the way around itself.
 - It can walk on mud easily and is a powerful swimmer.
 - It can stay warm even in cold water.

You may use a drawing to depict your imaginary animal, but you should also use words to describe each adaptation. Answers may include:

- **Eyes on the sides of its head, on stalks or bulging out from the head allow it to avoid predators because it can see nearly all the way around itself.**
- **Webbed feet allow it to walk on mud easily and make it a powerful swimmer.**
- **Water-repellant fur or feathers insulate it and help it stay warm even in cold water.**

Enrichments

Project WET:

- Water Address

Project WILD Aquatic:

- Fashion a Fish
- Fishy Who's Who

Guest speakers:

- Fisheries biologist. If invited for Activities 4.2 or 4.4, the speaker may be able to assist with instruction as well as talk about fish adaptations and hatchery spawning.
- Hatchery worker. If invited for Activity 4.2 or 4.4, the speaker may be able to assist with instruction as well as talk about fish adaptations and hatchery spawning.

Additional enrichments:

- Students keep a classroom aquarium.
- Students perform actual or virtual fish dissection.
- Fish maze (dichotomous key)